Climate Change Rating of Countries v4.1.2

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Abstract

This work proposes a system of Climate Change Rating of countries (CCR). The parameters included in the rating are CO2 emissions per capita and per GDP, cumulative CO2 emissions in the last 30 years, and changes in CO2 intensity in the last 10 years.
The parameters are compared to the world averages.
The CCR for 2020 includes 208 countries, 99.99% of the global CO2 emissions and population, and 99.83% of the global GDP.
The A-G rating groups are according to the rating limits. The best rating (A) is for the lowest CCR.
The world average CCR value in 2020 is 100, equivalent to group E.
The publication and the linked website include the rating and the details of each country.

Glossary

$$GDP	$2017 of cumulative GDP in the last 30 years
ΣGDP	cumulative GDP in last 30 years, $GDP
Ave	average
Black10	group of 10 countries from group G, the black group, with the highest CO2 emissions in the group
CCO2	global cumulative CO2 emissions according to publication [1] [2], CO2 emissions produced from fossil fuels and cement production only – land use change is not included, tCO2
CCp$$	country's cumulative CO2 emissions in the last 30 years per cumulative GDP in the same period
CCp$$W	weight of parameter CCp$$
CCR	Climate Change Rating of countries according to this work
CGP	Conservative Global Parameter, decreasing only world parameter applied to the CCR
CO2	emissions of Carbon Dioxide, CO_2
Cp$	country's CO2 emissions per GDP in the last year, tCO2/$GDP (ton CO2 per year, per $GDP 2017 per year)
Cp$10	country's change in Cp$ in last 10 years, tCO2/$GDP
Cp$10W	weight of parameter Cp$10
Cp$W	weight of parameter Cp$
CpC	country's CO2 emissions per capita in the last year, tCO2/y,cap
CpC10	country's change in CpC in last 10 years, tCO2/y,cap
CpC10W	weight of parameter CpC10
CpCW	weight of parameter CpC
GDP	Gross Domestic Product, constant international $ 2017, $GDP/y
Global Warming	global surface temperature change over land+ocean above 1850-1900 baseline, °C

ktCO2/y	kilo-ton CO2 = 1,000 metric tons of CO2 per year
MtCO2/y	Mega-ton CO2 = 1,000,000 metric tons of CO2
OWID	Our World in Data – Internet site [1] [2]
Ref	reference
tCO2	metric ton of CO2
tCCO2	metric ton of cumulative CO2 in the last 30 y
tCO2/y,cap	metric ton of CO_2 per year, per capita
WB	World Bank
WCCp$$	world cumulative CO2 emissions in last 30 years per cumulative GDP, tCO2/$GDP
WCp$	world CO2 emissions per GDP in the last year, tCO2/$GDP
WCp$10	world change in Cp$ in last 10 years, tCO2/$GDP
WCpC	world CO2 emissions per capita in the last year, tCO2/y,cap
WCpC10	world change in CpC in last 10 years, tCO2/y,cap

Parameters Included in the Rating

Table 1 - Parameters included in the rating

Parameter	Country Symbol	World Symbol	Unit
CO2 emissions per capita	CpC	WCpC	tCO2/y,cap
CO2 emissions per GDP	Cp$	WCp$	tCO2/$GDP
Cumulative CO2 in the last 30 years per cumulative GDP in the same period	CCp$$	WCCp$$	tCO2/$GDP
Change in CpC in the last 10 years	CPC10	WCPC10	tCO2/y,cap
Change in Cp$ in the last 10 years	CP$10	WCP$10	tCO2/$GDP

Weights of CCR Parameters

Table 2 - CCR parameters weight

Parameter	Parameter Symbol	Weight	Weight Symbol
Cumulative CO2 in the last 30 years per cumulative GDP in the same period	CCp$$	20%	CCp$$W
CO2 emissions per capita	CpC	25%	CpCW
CO2 emissions per GDP	Cp$	25%	Cp$W
Change in CpC in the last 10 years	CpC10	15%	CpC10W
Change in Cp$ in the last 10 years	Cp$10	15%	Cp$10W
Σ		100%	

Conservative Global Parameters

The CCR world parameters will change every year. There will be years when some world parameters will increase and some will decrease.
To ensure a conservative approach to the CCR, "Conservative Global Parameters" (CGP) will be applied every year and not the actual world parameters of this year.
If the value of the world parameter decreases below the value of the previous year's CGP, the new CGP will updated to the actual value of the world parameter.
If the value of the world parameter is above the last CGP, the CGP for the current year will remain the same as in the previous year.
For the first year of the CCR, 2020, the CGP equals the world parameters in 2020.

Climate Change Rating of Countries

Formula 1 - Climate Change Rating

$$CCR =$$
$$= [CCp\$\$W * CCp\$\$ / WCCp\$\$] +$$
$$+ [CpCW * CpC / WCpC] +$$
$$+ [Cp\$W * Cp\$ / WCp\$] +$$
$$+ [CpC10W * CpC10 / WCpC10] +$$
$$+ [Cp\$10W * Cp\$10 / WCp\$10]$$

CCR	Climate Change Rating of a country
CCp$$W	weight of parameter CCp$$
CCp$$	country's cumulative CO2 emissions in the last 30 years per cumulative GDP, tCO2/$GDP
WCCp$$	CGP of world cumulative CO2 emissions in the last 30 years per cumulative GDP, tCO2/$GDP
CpCW	weight of parameter CpC
CpC	country's CO2 emissions per capita in the last year, tCO2/y,cap
WCpC	CGP world CO2 emissions per capita in the last year, tCO2/y,cap
Cp$W	weight of parameter Cp$
Cp$	country's CO2 emissions per GDP in the last year, tCO2/$GDP
WCp$	CGP world CO2 emissions per GDP in the last year, tCO2/$GDP
CpC10W	weight of parameter CpC10
CpC10	country's change in CpC in the last 10 years, tCO2/y,cap
WCpC10	CGP world change in CpC in the last 10 years, tCO2/y,cap
Cp$10W	weight of parameter Cp$
Cp$10	country's change in Cp$ in the last 10 years, tCO2/$GDP
WCp$10	CGP world change in Cp$ in the last 10 years, tCO2/$GDP

A higher value of the calculations' result means worse CCR (more CO2 emissions, lower rating).

Sources of Data

The datasets are from the following sources:

- OWID [1] [2] CO2 emissions produced from fossil fuels and cement production only – land use change is not included
- World Bank (WB) [3] GDP, PPP (constant 2017 international $)
- United Nations (UN) [7] GDP (constant 2015 $)

CO2 emissions are without international transport.

More details regarding the datasets may be found in the publication [4].

Table 3 - Dataset [1] [2] [3] [4] [7]

	CO2 emissions	GDP	Population
Source of data	OWID	World Bank/OWID/UN	OWID
Reference	[1] [2] [4]	[3] [4] [1] [7]	[1]
Countries	208	208	208
From year	1990	1990	1990
To year	2021	2021	2021
CO2 from fossil fuels	Yes		
CO2 from cement production	Yes		
CO2 from other sources	No		
Other GHG	No		
Land use change	No		
International transport	No		
Units	MtCO2/y	Constant International $ 2017	
Resolution	1 ktCO2/y	1 Constant International $ 2017	

Table 4 - Completeness of Data

		Dataset	World	Dataset to World
countries		208	240	86.67%
CO2 emissions	MtCO2/y	34,326	34,326	100.00%
Population	Ex6	7,841	7,841	99.99%
GDP	Ex9$	126,513	126,732	99.83%

World CCR Parameters

Table 5 - World data for 2020

Parameter	Symbol	Unit	World 2020
CO2 emissions in 2020		tCO2/y	34,325,692,000
GDP		$GDP/y	126,732,219,588,076
Population			7,840,952,832
Cumulative CO2 emissions in the last 30 years		tCCO2	864,284,220,582
Cumulative GDP in the last 30 years		$$GDP	2,590,775,267,367,470
Cumulative CO2 in the last 30 years per cumulative GDP in the same period	WCCp$$	tCCO2/$$GDP	0.000334
CO2 emissions per capita	WCpC	tCO2/y,cap	4.38
CO2 emissions per GDP	WCp$	tCO2/$GDP	0.000271
CpC before 10 years		tCO2/y,cap	4.62
Cp$ before 10 years		tCO2/$GDP	0.000332
Last CpC to CpC before 10 years	WCpC10	tCO2/y,cap	95%
Last Cp$ to Cp$ before 10 years	WCp$10	tCO2/$GDP	81%

Conservative Global Parameters for 2020

2020 is the first year of CCR, therefore all CGPs are equal to the world parameters of 2020.

Table 6 - Conservative Global Parameters - CGP2020

Parameter	Parameter Symbol	CGP2020
Cumulative CO2 in the last 30 years per cumulative GDP in the same period	WCCp$$	0.0003336006143
CO2 emissions per capita	WCpC	4.377744993
CO2 emissions per GDP	WCp$	0.0002708521330
Change in CpC in the last 10 years	WCpC10	94.72665877%
Change in Cp$ in the last 10 years	WCp$10	81.47706217%

Example for Israel

Table 7 - Basic parameters for CCR for Israel in 2020 [4]

Parameter	Symbol	Unit	Israel	CGP (World)	Israel to CGP
CO2 emissions in 2020	CO2	tCO2/y	55,008,000	34,325,692,000	
GDP	GDP	$GDP/y	365,661,304,062	126,732,219,588,076	
Population			8,757,487	7,840,952,832	
Cumulative CO2 emissions in the last 30 years	CCO2	tCCO2	1,745,520,900	864,284,220,582	
Cumulative GDP in the last 30 years	ΣGDP	$GDP	6,975,474,716,130	2,590,775,267,367,470	
Cumulative CO2 in the last 30 years per cumulative GDP in the same period	CCp$$	tCCO2/$GDP	0.000250	0.000334	75%
CO2 emissions per capita	CpC	tCO2/y,cap	6.28	4.38	143%
CO2 emissions per GDP	Cp$	tCO2/$GDP	0.000150	0.000271	56%
CpC before 10 years		tCO2/y,cap	9.32	4.62	
Cp$ before 10 years		tCO2/$GDP	0.000261	0.000332	
Last CpC to CpC before 10 years	CpC10	tCO2/y,cap	67%	95%	71%
Last Cp$ to Cp$ before 10 years	Cp$10	tCO2/$GDP	58%	81%	71%

Table 8 - CCR Index for Israel in 2020

Parameter	Parameter Symbol	Value	Weight	Index
Cumulative CO2 in the last 30 years per cumulative GDP in the same period	CCp$$	75%	20%	15%
CO2 emissions per capita	CpC	143%	25%	36%
CO2 emissions per GDP	Cp$	56%	25%	14%
Change in CpC in the last 10 years	CpC10	71%	15%	11%
Change in Cp$ in the last 10 years	Cp$10	71%	15%	11%
Σ			100%	86%

The Climate Change Rating (CCR) of Israel for 2020 is 86, which means 14% better than the world average (100). Israel has 4 CCR indexes better than the world average. CO2 emissions per capita are 43% above the world average.

Table 9 - Israel's country page on the website [5]

Nowagreen Climate Change Rating of Countries - CCR 2020

country: Israel (ISR) 2020

country	Israel
country code	ISR
CCR year	2020
CO2 emissions per capita (CpC), tCO2/y,cap	6.28
CpC to World	143%
CpC weight	36%
CO2 emissions per GDP (Cp$), tCO2/$GDP	0.00015
Cp$ to World	56%
Cp$ weight	11%
cumulative CO2 emissions in the last 30 years per cumulative GDP (CCp$$), tCO2/$GDP	0.00025
CCp$$ to World	75%
CCp$$ weight	15%
change in CO2 emissions per capita in the last 10 years (CpC10), tCO2/y,cap	67%
CpC10 to World	71%
CpC10 weight	11%
change in CO2 emissions per GDP in the last 10 years (Cp$10), tCO2/$GDP	58%
Cp$10 to World	71%
Cp$10 weight	11%
CCR Rating a lower number means less CO2 and a better rating	86
country position on the CCR list of a total 208	114
A-G CCR label	D

Rating A-G

Rating A-G includes 7 groups.

Currently, the dataset includes 208 countries. On average there may be about 30 countries in each group.

The CCR limits for each group are set according to the following criteria:

- Rating A is below half of the world average, CCR <= 50
- Rating E is below the world average, CCR <=100
- Rating F is above the world average but less than 150% of the world average, 100 > CCR <= 150
- Rating G is above 50% of the world average, CCR > 150
- Ratings B, C and D are set considering rounded CRI limits and the number of countries in each group in 2020

In the next years the CCR limits will remain constant, which will cause a change in the number of countries in each group, hopefully more countries in Green-Blue groups and less in Violet-Red-Black groups.

Following is a proposal for the A-G groups

Table 10 - A-G groups

Rating	min CCR	max CCR	Color
A		50	Light Green
B	51	60	Dark Green
C	61	70	Light Blue
D	71	85	Dark Blue
E	86	100	Violet
F	101	150	Red
G	151		Black

Table 11 - A-G groups in 2020

Rating	Ave CCR	tCO2/y	countries 2020
A	43.1	64,240,675	13
B	55.5	452,596,360	24
C	65.8	1,289,499,182	30
D	77.2	2,947,234,126	44
E	91.9	4,553,560,059	35
F	120.9	8,567,596,157	34
G	209.6	16,440,549,561	28

CCR Ratings

Proposed details on the CCR country Rating

- The year of the rating
- Country Flag
- Country ISO Code
- Country Name
- The country rating A-G in the related color
- The number on the countries list, starting with the best and number of all countries in the list
- Value of the rating, indicating that a lower value means less CO2 emissions
- Table of CCR parameters of the country and the Conservative Global Parameters
- Table of CCR indexes of the country

Climate Change Rating of Countries on the Website

The Climate Change Rating of countries for 2020 (CCR2020) according to this work is available on the website nowagreen.com/ccr [5].

Table 12 - Climate Change Rating of Countries on the website [5]

Nowagreen Climate Change Rating of Countries - CCR 2020
sorted by country code

for more details click on country code

country code	country	CCR	position on CCR list	A-G Rating
ABW	Aruba	99	143	E
AFG	Afghanistan	58	29	A
AGO	Angola	40	4	A
AIA	Anguilla	156	182	G
ALB	Albania	61	39	B
AND	Andorra	90	127	E
ARE	United Arab Emirates	202	196	G
ARG	Argentina	82	105	D
ARM	Armenia	86	113	D
ATG	Antigua and Barbuda	93	132	E
AUS	Australia	171	190	G
AUT	Austria	90	131	E
AZE	Azerbaijan	110	154	F
BDI	Burundi	71	70	C
BEL	Belgium	99	146	E
BEN	Benin	65	46	B
country code	country	CCR	position on CCR list	A-G Rating
BFA	Burkina Faso	78	97	D
BGD	Bangladesh	58	35	B
BGR	Bulgaria	103	150	E

Versions

Changes in this version

- Minor editorial corrections

References

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